Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

$$\therefore y = -\frac{61a^4b}{360EI} = \text{deflection required.}$$

For cantilever beam, length $2a$, with the same load,

$$EI\frac{d^2y}{dx^2} = -A(x-z) = -\frac{2bx^3}{3a} + \frac{bx^4}{4a^2},$$

$$EI\frac{dy}{dx} = -\frac{bx^4}{6a} + \frac{bx^5}{20a^2} + C; \text{ when } x=2a,\ dy/dx=0,\ C=\tfrac{16}{15}a^3b.$$

$$\therefore EI\frac{dy}{dx} = -\frac{bx^4}{6a} + \frac{bx^5}{20a^2} + \tfrac{16}{15}a^3b.$$

$$EIy = -\frac{bx^5}{30a} + \frac{bx^6}{120a^2} + \tfrac{16}{15}a^3bx = \tfrac{24}{15}a^4b, \text{ when } x=2a.$$

$$\therefore y = \frac{24a^4b}{15\,EI} = \text{deflection at end of beam.}$$

Also solved by Harold Rowe.

242. Proposed by C. N. SCHMALL, 604 East 5th Street, New York City.

In a certain New York theatre there is an asbestos curtain supported by thin circular rings, radius r, which move on a cylindrical rod of radius a. The curtain is intended to be drawn by a *steady pull.* Taking μ as the coefficient of friction, show that this will not be possible if r be less than $a\sqrt{(1+\mu^2)}$.

Solution by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

Let P be the resultant pull on a ring, θ the angle between the direction of P and the normal to the surface of contact of ring and rod.

Then $P\cos\theta$=resolved part of P along the normal, and $P\sin\theta$=resolved part at right angles to the normal. For equilibrium, $P\sin\theta < \mu P\cos\theta$.

$$\therefore \sin^2\theta < \mu^2\cos^2\theta, \text{ or } \cos^2\theta > \frac{1}{1+\mu^2}.$$

The diameter of the ring is in the direction of P; diameter of rod is the normal.

$$\therefore \cos\theta = \frac{a}{r}. \quad \therefore \frac{a^2}{r^2} > \frac{1}{1+\mu^2} \text{ or } r < a\sqrt{(1+\mu^2)}.$$

243. Proposed by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

A weight W is supported by three strings of the same size and quality lying in the same plane. The middle string is vertical, one string makes with it an angle θ on one side, and the other string makes with it an angle ϕ on the other side. Find the stresses T_1, T_2, T_3 in the strings.

Solution by the PROPOSER.

Let AQ be the vertical string; BQ, CQ, the strings making angles θ, ϕ with AQ, respectively. Let $AQ=a$, $BQ=b$, $CQ=c$, $E=$Young's modulus, $\beta=$the sectional area of string, elongation of $AQ=a_1$, of $BQ=b_1$, of $CQ=c_1$; T_1 the stress in AQ; T_2 the stress in BQ; T_3 the stress in CQ.

Then $T_1+T_2\cos\theta+T_3\cos\phi=W$...(1).

$T_2\sin\theta=T_3\sin\phi$...(2).

$T_1a_1+T_2b_1+T_3c_1=\text{minimum}$...(3).

But $a_1=aT_1/(E\beta)$, $b_1=bT_2/(E\beta)$, $c_1=cT_3/(E\beta)$. Hence (3) becomes

$$(T_1^2a+T_2^2b+T_3^2c)/(E\beta)=\text{minimum}.$$

Now $a=b\cos\theta=c\cos\phi$.

$$\therefore \frac{a}{E\beta}\left[T_1^2+\frac{T_2^2}{\cos\theta}+\frac{T_3^2}{\cos\phi}\right]=\text{minimum}...(4).$$

From (1), $dT_1+dT_2\cos\theta+dT_3\cos\phi=0$...(5).

From (2), $dT_2\sin\theta=dT_3\sin\phi$...(6).

From (4), $T_1dT_1+(T_2/\cos\theta)dT_2+(T_3/\cos\phi)dT_3=0$...(7).

Eliminating dT_1, dT_2, dT_3 between (5), (6), (7), we get

$$T_1\cos\theta\sin(\theta+\phi)=T_2\sin\phi\cos\phi+T_3\sin\theta\cos\theta...(8).$$

From (1), (2), and (8),

$$T_1=\frac{W(\sin^2\phi\cos\phi+\sin^2\theta\cos\theta)}{\sin^2\phi\cos\phi+\sin^2\theta\cos\theta+\cos\phi\cos\theta\sin^2(\theta+\phi)},$$

$$T_2=\frac{W\sin\phi\cos\phi\cos\theta(\sin\phi\cos\phi+\sin\theta\cos\theta)}{\sin^2\phi\cos\phi+\sin^2\theta\cos\theta+\cos\phi\cos\theta\sin^2(\theta+\phi)},$$

$$T_3=\frac{W\sin\theta\cos\theta\cos\phi(\sin\phi\cos\phi+\sin\theta\cos\theta)}{\sin^2\phi\cos\phi+\sin^2\theta\cos\theta+\cos\phi\cos\theta\sin^2(\theta+\phi)}.$$

If $\theta=\phi$, $T_1=\dfrac{W}{(1+2\cos^3\theta)}$. $T_2=T_3=\dfrac{W\cos^2\theta}{(1+2\cos^3\theta)}$.

(See problems 186d, 186e, page 476, Merriman's *Mechanics of Materials.*)